DETAILED ACTION

The Response, filed on January 4, 2010 has been entered and acknowledged by the Examiner.

Claims 1-13 are pending in the instant application.

Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-4,6-10, 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pub 2003/0042850 to Bertrum et al., and further in view of Dabbousi et al. (Appl. Phys. Lett. 66 (11) 13 March 1995)

Regarding claim 1 Bertrum discloses (Figs. 1,2 para [0006] – [0009], [0023],[0025],[0029]) a method comprising the steps of providing an organic matrix 3 of polymeric organic material with embedded quantum dots, providing one or more transfer molecules (capping molecules) on the surface of the quantum dots, supplying electrons and holes to the matrix using first and second electrical contacts 2,4 in electrical contact with the organic matrix, generating excitons, and transferring excitons

from EL organic molecule to transfer molecules on the quantum dots and transferring excitons from the transfer molecules to the quantum dots.

Bertrum discloses the claimed invention with polymer organic material for organic matrix but does not expressly disclose organic matrix comprising electroluminescent organic molecules.

Dabbousi in same field of endeavor discloses (page 1316) a device with quantum dots (nanocrystallites) of CdSe embedded in an organic matrix of electroluminescent polyvinylcarbazole (PVK) and oxadiazole derivative. Dabbousi further submits that when CdS quantum dots are incorporated into electroluminescent PVK, enhanced photoconductivity is demonstrated.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to substitute the organic matrix of polymeric organic material of Bertrum with organic electroluminescent PVK molecules embedded with quantum dots of CdSe as suggested by Dabbousi for providing enhanced photoconductivity.

Regarding claim 2 Dabbousi discloses dispersing nanocrystals (quantum dots) of CdSe in a solution of organic molecules (choloroform along with 3:2 mixture by weight of polyvinylcarbazole) and thus forming matrix of organic molecules embedded with quantum dots.

Regarding claim 3 Bertrum as modified by Dabbousi discloses the hole and electron processing means each comprising two layers hole injecting on the substrate and hole transporting and electron injecting and electron transporting on the top of light

emitting layer, the electron and hole blocking (transporting) layers being adjacent to the matrix.

Regarding claims 4, 6 and 7 Bertrum as modified by Dabbousi discloses (para [0020]-[0025]) one or more transfer molecules comprising fluorine polymer, fluorine oligomer, the quantum dots comprising CdSe and EL organic molecules comprising poly(phenylene vinylene) or PPV. These compounds being same as those disclosed by the applicant, it is anticipated that Bertrum as modified by Dabbousi discloses transfer molecules have a bandgap smaller than the bandgap of EL organic molecule (PVK) and larger than the band gap of quantum dots, transfer rate of excitons from EL organic molecules to transfer molecules is larger than decay rate of excitons in EL organic molecules and transfer rate of excitons from transfer molecules to the quantum dots is larger than the decay rate of excitons in the transfer molecules.

Claim 8 essentially recites the same limitations as of claim 1 and claim 6 for quantum dot embedded organic molecule device and step of providing one or more transfer molecules comprises providing transfer molecules so that the transfer rate of excitons from transfer molecules to the quantum dots is larger than the decay rate of excitons in the transfer molecules (transfer molecules, quantum dots and electroluminescent organic molecules being the same as disclosed by the applicant) and hence is rejected for the same reason(see rejection of claims 1 and 6).

Claim 9 essentially recites the same limitation as of claim 7 for the device and hence is rejected for the same reason.

Regarding claim 10 Bertrum as modified by Dabbousi discloses the EL organic molecules (PVK) are electroluminescent polymers.

Regarding claim 11 Bertrum and Dabbousi disclose the method of fabricating light emitting quantum dot embedded organic device comprising the steps of providing a solution of EL organic molecules and solution of quantum dots with transfer molecules attached to the surfaces (transfer molecules : fluorine polymer , organic EL molecule: PVK and quantum dots: CdSe – having the same compositions as those disclosed by the applicant possess the band gaps such that $E_{transfer} < E_{org.mol.}$ and $E_{transfer} > E_{QD}$) , mixing the solutions, providing first electrical contact and forming the matrix of organic EL molecules with embedded quantum dots on the first electrical contact and depositing the second electrical contact on the matrix.

Regarding claim 12, Bertrum discloses the process further comprises steps of forming between the matrix and the first/second electrode a material layer for enhancing hole transport.

Regarding claim 13, Bertrum discloses the process further comprises steps of forming between the matrix and the second/first electrode a material layer for enhancing electron transport.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dabbousi et al. (Appl. Phys. Lett. 66 (11) 13 March 1995) and further in view of US Pub 2003/0099860 to Lin et al.

Regarding claim 5 Bertrum as modified by Dabbousi discloses ([0023]-[0025]) different fluorescent transfer molecules such as perylene derivative, DCM, coumarine but does not exemplify selecting phosphorescing transfer molecules.

Lin in analogous art of organic EL device discloses (para [0033]) DCM, Coumarin, perylene or phosphorescent medium can be used as luminescent medium and hence these are recognized as art equivalents.

It would have been obvious to one of ordinary skill in the art at the time of invention to use phosphorescing transfer molecules as suggested by Lin instead of fluorescent transfer molecules of Bertrum as modified by Dabbousi since these are art recognized equivalents for luminescent material.

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over US Pub 2003/0042850 to Bertrum et al., and further in view of Mattoussi et al. (J. Applied Physics 1999, 86,4390-4399).

Regarding claim 1, Bertrum discloses (Figs. 1, 2 para [0006] – [0009], [0023],[0025],[0029]) a method comprising the steps of providing an organic matrix 3 of polymeric organic material with embedded quantum dots, providing one or more transfer molecules (capping molecules) on the surface of the quantum dots, supplying electrons and holes to the matrix using first and second electrical contacts 2,4 in electrical contact with the organic matrix, generating excitons, and transferring excitons from EL organic molecule to transfer molecules on the quantum dots and transferring excitons from the transfer molecules to the quantum dots.

Bertrum discloses polymer organic material for organic matrix but does not explicitly disclose organic matrix comprising electroluminescent organic molecules.

Mattoussi in same field of endeavor discloses (page 4390,4391, Fig.7) LED made of composite film of electroluminescent organic material such as poly(N-vinylcarbazole) (PVK), phenylbiphenyloxadiazole (PBD), polyphenylene vinylene (PPV) and CdSe nanocrystals. Mattoussi teaches these polymers can be tailored to provide surface passivation of the nanocrystal and charge transport into the particle core where recombination takes place and provides higher EL emission efficiency.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to specify the organic matrix of polymeric organic material of Bertrum as organic electroluminescent matrix embedded with quantum dot as suggested by Mattoussi for providing surface passivation of the quantum dots (nanocrystal) and charge transport into the particle core where recombination takes place and providing higher EL emission efficiency.

Response to Arguments

Applicant's arguments with respect to claim1 have been considered but are moot in view of the new ground(s) of rejection.

The Examiner also points out that no argument has been provided regarding rejection of claim 1 by Bertrum and Mattoussi presented in previous final office action.

Conclusion

Applicant's amendment filed 8/24/09 necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sikha Roy whose telephone number is (571) 272-2463. The examiner can normally be reached on Monday-Friday 8:00 a.m. – 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimeshkumar D. Patel can be reached on (571) 272-2457. The fax phone number for the organization is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Sikha Roy/
Primary Examiner, Art Unit 2879